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A
REPORT
TO THE
BUFFALO MEDICAL ASSOCIATION
CONCERNING AN
EXAMINATION OF THE EYES
OF
1003 SCHOOL CHILDREN,
BY
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LUCIEN HOWE, M. D.

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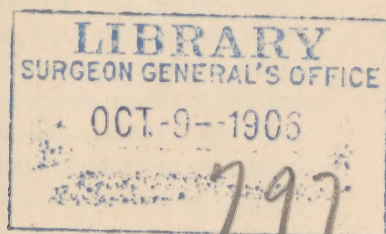
BUFFALO:

BAKER, JONES & CO., PRINTERS AND BINDERS.

1877.

The following report having been presented at an association of general practitioners, it was thought better to give an outline of the entire subject than to consider at length such points as might be more interesting to the specialist. For this reason a discussion of conflicting views has been avoided, and the statements concerning the influence of position, of accommodation, and of the form of desk, have been made with few, if any, qualifications. The increasing proportion of myopes with advancing age was so illustrated by diagrams, as to make a more extended description unnecessary. All the data relating to the examination are, however, still in the possession of the writer, arranged in such a form as to be useful for future reference and will be placed at the disposal of any one who may be interested in further details.

9 Niagara St., Buffalo, April, 1877.



REPORT

TO THE

BUFFALO MEDICAL ASSOCIATION.

At a former meeting of this Association it was seen fit to ask for a report concerning the effect of study upon the eyes of pupils in our public schools. As the person to whom this work was entrusted, and as a member of our standing sanitary committee, I have followed out the plan of investigation then proposed, and would now invite your attention to a general view of the conclusions arrived at. Such an inquiry seemed to be in accordance with the true spirit of professional zeal, and with one of the prime objects of our Association, inasmuch as it related to the sanitary condition of a large part of our city's population. For in Buffalo there are over twenty thousand human beings whose mode of life, whose daily occupation, and whose surroundings are, in general, the same. In order to prepare these people for future usefulness we build houses in which they can be brought together, hire persons competent to instruct them, and provide such other additional means for their improvement that the yearly cost does not fall short of \$300,000. But while exercising this care of their mental culture, their physical needs are neglected to a marked extent. The only heed given to health, is in the form of such general precautions as may force themselves on the attention of the already occupied teachers, and as a consequence the pupils suffer from an oversight which is decidedly to their disadvantage. So universal, indeed, is this indifference to sanitary principles, particularly in respect to school architecture, and so sure is it that long-continued study has an injurious effect upon the eye, that in the present instance it became simply a question of degree as to the

result of the unfavorable influences here exerted. The fact that school life tends to produce an unhealthy condition of this organ was first established by Professor Cohn, of Breslau, from an examination of the eyes of over ten thousand children. His results have since been verified by many of the first oculists in Europe, and now, within the past few years, just such investigations have been instituted in New York, Brooklyn, Cincinnati and other cities of the United States. The plan which I followed in procuring the data relating to the schools of Buffalo was similar to that of other observers, and identical with that of Drs. Agnew and Webster in regard to schools in New York. To the former of these gentlemen, I am indebted for valuable suggestions in prosecuting the work. He very kindly sent me a quantity of blanks specially prepared for recording everything relating to the examination. With the name, age and sex, there was to be noted every possible variation found in the vision of the different pupils. Besides this, their height and the relative height and exact size of the desks and seats. Also for each room, the color of the walls, the number of windows to the right, left, front and rear; the number of square feet in each, and the distance of adjacent buildings, which might obstruct the light. Moreover, the methods of teaching by large objects, the hours of study, number of recesses, methods of heating and ventilation and cubic feet of air to each individual. It will be seen that the greatest care was exercised in recording,

1. The precise condition of each pupil's vision, whether healthy or not, and if abnormal, to what degree.
2. The usual position of the body when studying.
3. The illumination of the school room.
4. The relaxation given to the eye alone or to the entire body.
5. The general hygienic surroundings of the pupil. It must not be understood, however, that the process of individual examination was either complicated or unpleasant. It was simple in the extreme. Half a dozen scholars at a time were usually sent into a class-room. There they found a set of letters hanging on the wall, which are known among oculists as Snellen's test-types. It will be remembered that these letters are so chosen and constructed that

at a given distance each one of them subtends a certain angle at which rays of light enter the eye, and it is found by a vast number of trials, that a person not near-sighted sees the upper letter at 200 feet, the next line at 100, the next at 70, and so on down to the lowest line at 20 feet. All that is necessary, therefore, is to have the types at the proper distance, say 20 feet, and ask the pupil if he can read the line corresponding to that distance. If he can, we know at once that he is not near-sighted. Then to prove that he is not manifestly far sighted, there is held before the eye such a weak convex glass as most old people are accustomed to wear. With this he ought not to see as well; if he does not, that is sufficient. The whole process has not occupied half a minute. Such was the course followed with each scholar, and in cases of unusually imperfect vision the cause was also sought by means of the ophthalmoscope. This simplicity was adhered to throughout, and with it the examination ended. Whenever the scholar afterwards asked as to his own condition, particular care was taken to answer but few, if any questions, and especially to avoid any reply of an alarming or advisory nature. In the different schools examined, however, there are almost a dozen pupils with such diseases as retinitis, choroiditis and rapidly progressing myopia, who are daily injuring what vision they have by continuing their studies. Some of them readily noticed how imperfect was their eyesight when compared with that of their class-mates, and inquired anxiously as to the cause. Any other answer than one calculated to quiet their fears might have subjected my motives and the entire plan to unpleasant criticism, and would have been received probably with as little favor as is usually given to voluntary advice. I was there to learn, not to teach. The schools chosen for this examination were Nos. 10, 13, 14, the Central and Normal. To a certain extent these are typical, and whatever is said of one might apply to any other in the city which is constructed on the same plan. Thus, Nos. 2, 3, 4, 5, 7, 8, 9, 11 and 12 are similar to No. 10. Nos. 1, 13, 19 and 31 are like No. 13, and No. 30 is the same as No. 14.

The data which were collected, I here present. They will be found to cover nearly 60 pages of these quarto forms and about 20

pages of foolscap. On one set of the papers there is recorded the precise condition of each pupil's eyesight with other facts relating to the position, illumination, method of study, etc., etc. On another the scholars are all classified according to their ages and power of vision, the two sexes being represented in different colored inks. This array of names and figures gives some idea of the amount of work involved in the inquiry. One thousand times the same set of questions have been regularly and systematically asked, and one thousand times the answers have been carefully noted. Subsequently it was necessary to arrange the data in order to calculate the proportions and make inductions accordingly. The number of scholars examined in each school was as follows: At No. 10, 301; No. 13, 51; No. 14, 214; at the Central 319, and at the Normal 118, making a total of 1,003. Of these 65. per cent. had normal, healthy eyes, 3.4 per cent. had visual defects which could not be improved by glasses, 11.9 per cent. were far-sighted, 19.7 per cent. were near-sighted.

Of those cases in which it was impossible to remedy the optical imperfections, the causes were such as not to concern us directly in an inquiry like this. They were from diseases, partly congenital partly acquired, and were not greater in number or degree than might have been expected under the most favorable circumstances. Nor is the far-sightedness of special importance in this connection.

But it is this nineteen per cent. of those who are near-sighted, or what is the same thing myopic or myopes, to which our attention should be specially directed. In order to appreciate the importance of the subject let us digress sufficiently to recall the anatomical condition on which the symptoms depend. In the healthy eye, of course, parallel rays are brought to a focus exactly on the retina, but if from any cause the distance between the lens and the retina be lengthened, then the only rays which can meet there, are those which on entering are divergent—those which come from a near point. In other words, whenever the eye is lengthened from before backwards, it is near-sighted. And just such a lengthening does occur. Pure myopia depends on a distention of the tunics of the globe in such a manner that the outer one, the sclerotic, is pushed backwards in the vicinity of the optic nerve, and we have

usually a condition resulting, known as posterior staphyloma. This state of affairs is far from healthy either as regards the structure for the time being or the liability to morbid changes in the future. To make this clear I cannot do better than quote from Donders.

He says: "The well known fact that myopes with a little light can recognize small objects, and especially the fact that at an advanced period of life they need no glasses to enable them to see near objects, procured almost general acceptance for the prejudice that near-sighted eyes are to be considered particularly strong. Many medical men even participate in this error. But the oculist has only too often been convinced by sad experience of the contrary. I have no hesitation in saying that a near-sighted eye is not a sound eye."

He then goes on to demonstrate the changes which accompany progressive myopia, such as excessive distention of the sclerotic coat with atrophy of the choroid, alterations in the surface of the optic nerve and in the yellow spot, with other morbid processes which interfere directly and permanently with vision. A superficial observer might imagine that even this eminent author was inclined to lay unnecessary stress upon a point apparently trivial, but it is those who have studied the subject most thoroughly, who are the most impressed with its importance. In a monograph which Prof. Arlt of Vienna has just published on the cause of near-sightedness, he concurs in these views and illustrates the changes which occur in the ciliary muscle. To avoid a long description of these changes it seemed best to present the plates themselves, and for the same reason I call attention to those representations in Liebrich's Classical Atlas, which illustrate the diseased conditions often accompanying near-sightedness. Figures 5 and 6 of plate III, remind one forcibly of a case which I had the pleasure of presenting at a meeting of the Medical Club of this city on the 29th of November last. The patient was a woman 53 years old, who was afflicted with excessive myopia and its accompanying evils, to such an extent that she could find her way about with difficulty, even by the aid of glasses. Such examples are fortunately extremely rare. This impairment of vision is of so much more importance than any resulting deformity, that I pass over that phase of the subject simply

with the statement that in two-thirds of the cases where an eye turns outward, this divergent strabismus accompanies near-sightedness. Besides, this condition is incurable. The more that we learn of myopia, the less hope is there of finding a satisfactory method for the treatment.

The symptom can be temporarily removed by means of a lens, but that is all.

It seems then fairly established that we are considering a disease, one that is incurable, always inconvenient and sometimes dangerous.

Let us next inquire as to the relation of this disease to fine work, particularly reading and writing. Such a connection has been long suspected, but it was quite recently that two conclusive facts in regard to it were clearly and statistically proven.

They are:

First, that near-sightedness is not of frequent occurrence among the illiterate; and

Second, that it is of frequent occurrence among the more cultivated, and that frequency increases in proportion to the standard of education. The investigations of Prof. Cohn, of Breslau, led him to think that about two per cent. was the average number of near-sighted persons among those whose vision was not impaired by study or fine work. Of 213 cases of eye disease seen during the past year among the paupers of Buffalo, the record shows only three and one-half per cent. to have been near-sighted.

On the other hand, when any collection of persons among the better educated is examined with reference to this, the number is found to be greater. Moreover, if that examination is conducted at the time during which they are pursuing their studies, it is invariably the case that the near-sightedness begins in a slight degree in the more elementary classes, and then increases rapidly and steadily the higher up in the grade we go. The statistics gathered by other observers are similar in every respect to those furnished by the schools of Buffalo. To illustrate this gradual progression as it occurs here, I have represented it by a curve which intersects horizontal lines corresponding to the ratio, and perpendicular ones representing the ages. Among the children under six

we find none who are near-sighted. By the time they are seven years old, five per cent. of them have acquired the disease. At eleven there are eleven per cent., at thirteen nineteen per cent., and so on up to eighteen, when twenty-six per cent. are near-sighted. In case they continue at school beyond the age of twenty-one, then no less than forty-three per cent. are in that condition. The progression is for the most part perfectly regular. It must be noticed, however, that at the extremes of this series there are not a sufficient number of examples to be of value statistically. They happen to conform to the general rule, but that is only a coincidence.

From the age of nine, however, to nineteen the number is large enough in each grade to be counted on with certainty and within these limits we may say that the curve here drawn represents accurately the increasing frequency of the disease. On the perpendicular line corresponding to seventeen years the curve of the progression has reached the point indicating twenty-four per cent. This is the average age of the members of the most advanced class at the Central. We cannot, therefore, escape the conclusion that one pupil out of almost every four graduated at our high school, is made partially near-sighted for life.

It must be observed again that the curve here drawn, does not represent the proportion of those in whom the disease has reached a dangerous or uncomfortable degree. In the majority of the cases (59 per cent.) the trouble exists to an extent hardly noticeable. But the seeds of the disease are sown there, and it might require only a longer course of study or some exciting cause in after life, to develop them into a condition, which to say the least, is inconvenient.

A certain number, however, do show the effects of an unpleasant degree even before leaving school. Those who require a glass of 30-inch focus and stronger, constitute 41 per cent. of the number myopic, or 8 per cent. of the entire list.

The data show, furthermore, that in schools where the hygienic conditions relating to the position of the pupils and the amount of light are disregarded, the proportion grows larger, and conversely, where those relations are observed, the number diminishes. This difference in individual schools exists to such an extent as

to make it apparent, but not in the striking degree found in some other cities. If a certain set of buildings had all of the architectural advantages, and others all of the disadvantages, the contrast would probably be as well marked here as it is elsewhere. Without dwelling on the peculiarities of struction in detail, I would simply state that, from an ophthalmic point of view, the different schools examined rank about as follows: First, the Normal; then No. 13; next, the Central; and lastly, Nos. 10 and 14.

Finally, a comparison of the number of myopic pupils among the boys and girls shows the proportion to be as 4 to 5. This is as we might expect, for the former, who lead an active out-door life during play hours, would be less liable to the disease than girls, who spend that interval too often with their story-book or needle. There are undoubtedly many other influences besides school life which produce near-sightedness, as it is found occasionally among the extremely illiterate, and on the other hand some of the most diligent students show no signs of it. For this reason it is necessary to consider the habits of the child at home, and the general surroundings, before blaming the schools too much. Such cases taken as they occur singly, or in small collections, furnish excellent material for the study of individual peculiarities.

But when the deductions are not made from tens or hundreds, but from thousands, then the conclusions are more exact. So in the present instance, the records concerning the vision of school children now relate to over 20,000 individuals, and in every country and by every observer, the same general conclusions are invariably arrived at. The question in a given city is simply one of degree.

There is one other important factor in the problem, however, which deserves at least to be mentioned. That is what we call hereditary tendency. It is a well established fact that such defects are transmissible to the offspring, even sometimes when acquired by the parent. This has an important bearing on the future, for the children of one generation intermarrying will entail their disease upon the next, but in the meanwhile, the same unfavorable influences being at work, the number of those afflicted would increase not in an arithmetical, but in a geometrical ratio. It is reasona-

ble to suppose that this law of transmission, together with the difference in the standard of education now and a century ago, explains the more frequent occurrence of myopia in our own time.

Such considerations in regard to the future or the past may not concern us practically, but in regard to the present, two propositions seem to be fully established:

1st. That near-sightedness is an incurable disease, and as such not simply inconvenient but also dangerous to vision.

2d. That it exists in our schools, and is to a certain extent produced and increased by study there.

The question naturally follows, How can the dangers be lessened or removed? To answer that let us consider two mechanical causes which might produce a lengthening of the globe, by distending it from within, or by pressure from without.

The normal standard of intraocular tension is liable to singular variations, but one way in which it can be augmented is by means of hydrostatic pressure. If the blood vessels in the interior of the eye are filled beyond the usual degree they occupy a correspondingly increased space. This occurs under the influence of gravity whenever the head is bent downward and forward for a sufficient length of time. In other words it is the position of the body that distends the eye—it is the position that makes it near-sighted.

With school children, however, the stooping posture assumed is not always a fault of theirs. It may be that the desks are so constructed as to favor just such positions. Suppose the pupil is one of those elongated specimens of half-grown boys whose legs sprawl out over an indefinite area every time he sits down. It is not physically possible for him to be comfortable in a seat which is made for one, half his height. He may not be any more apt, however, than many others much smaller, but because he happens to recite in the same class according to the rules of some schools, he is condemned to be crammed into a seat entirely too small for him. This may be an imaginary case as far as Buffalo is concerned, but the supposition brings up the question as to what is the most advisable form of the seat and desk. That is not so easily answered, either theoretically or practically, but the authorities on the subject seem to agree in the leading points. In

the first place as to the height of the seat. This should never exceed the length of the lower leg of the individual, and by a series of measurements of children made by Dr. Fahrner, of Zurich, the distance was found to be on an average two-sevenths the entire length of the body. The back can be comfortably inclined by a curve following the direction of the spine, and in general, the easier it is, the better. The second point of importance is the height of the desk above the seat. This should be equal to the height of the elbow above the seat, and by a series of measurements that has been found to be in boys one-eighth and in girls one-seventh, of the entire length of the body. The size and precise inclination of the top, is not a matter of so great moment. But there is one other requisite remaining. It is that the desk be not too far removed from the seat. This of itself necessitates stooping over. Either the edge of the desk should be on a perpendicular line with the edge of the seat, or overlap it by about an inch.

Now this may seem to be unnecessary, minutiae, and of no use practically, but the more one has occasion to consider the matter critically, the more does exactness become necessary. The question of position, then, is one of importance, and for the eye, as for the entire body, an essential hygienic law is, to sit up straight.

And now applying this principal to our home schools, I find that the teachers seem fully impressed with its significance. Many of the departments are models of discipline, and even the youngest children can be seen marching in and out with hands behind them, straight as little soldiers. But when seated, it is more difficult to keep them erect. And to my mind the cause lies more in the poorly constructed desks, than in the natural restlessness of the children. In the first place, there is not a sufficient variety in the sizes to correspond to the heights of the pupils. In the primary department of No. 19, for instance, the heights of the children range from three feet two inches to four feet eight inches, and yet they are all seated at desks of the same size. A similar, or even greater disproportion exist at No. 13, and to some extent at No. 14.

In the higher grades of all the schools, there are usually two sizes of desks, but in my opinion there should be three or four varieties in each department. Again, the desks and seats already there, are not constructed on the most approved plans. The general fault is, that the seats are too low and the plane on which the book rests is too high. As for the distance between seat and desk no definite plan seems to have been followed, some of the seats being several inches away from the perpendicular line of the edge of the desk, and others overlap it an equal distance. In European schools there is almost invariably a foot-rest, which is not often found in America, and never in Buffalo. By this simple arrangement the normal position of the ankle is retained and the comfort of the pupil more fully assured. So much for the position. Let us pass to another factor in the problem—illumination.

I said just now that the eye could be lengthened not only by distending it from the inside, but by pressure on the outside. This pressure is due principally to the muscles attached to the exterior. There are six of these arranged in such a way, that they are only at rest when a person is looking straight ahead and off in the distance. Look to the right and they pull in one direction, to the left, and they pull in another. Look at an object immediately in front, and the two eyes are drawn inwards more and more closely the nearer it approaches. If a person were to practice reading with the type only three or four inches off he would soon find that he must continue to do so—that he would be near-sighted. In the effort at convergence, the muscles would have pressed upon the eye so hard as to flatten it out, as it were, from before, backwards.* But what would induce him in the first place to hold the book so near? The want of sufficient light—and this is arriving at the second point that I wish to make. Good position first, and good light next. But this does not mean a dazzling blaze, shining full in one's face. Nor is it well to have the light behind, so that the body darkens the entire desk, or at the right, where the hand shades what is being written, but preferably at the left or above.

Making the practical application of this fact to our schools, the

* Donders' *Anomalies of Accommodation and Refraction*, p. 343.

records again teach an important lesson. They show as to the amount of light, that it is in some instances insufficient. At No. 10 the teachers say they often notice the pupils bending over their books, particularly on cloudy days. In the boys' room at the Central it is sometimes necessary to use gas, and at No. 14 the light supply is also poor. At No. 13, however, it is good, and at the Normal, excellent.

As to the direction from which it comes some material improvements might easily be made. It is not unfrequently the case in the class-rooms that the teacher sits with her back to the windows, allowing the light to fall full in the face of pupils. This order might be reversed in class-rooms Nos. 2, 6, 11 and 12 at the Central, in two rooms at No. 10, and in two also at No. 14.

There is one other precaution to be added, in regard to this continual muscular strain, which is, that the eyes have frequent periods of rest. If such a thing were practicable it would be well to allow them a sort of recess every fifteen or twenty minutes. I know the principal difficulty is, to make scholars look on their books and not off, but I do know also that among the more advanced classes we find those who study hour after hour with little intermission. It is these to whom I refer, and as I say, they should be told to rest their eyes every now and then, for the muscles of that organ require relaxation as much as any other. But if in spite of care in the position, the amount of light and every other requisite; there are still some pupils who find themselves growing near-sighted, what is to be done? They should wear glasses. The danger is not in using them too soon, it is in choosing the wrong kind. To continue wearing a hastily chosen pair, simply because a person can see with them, is just the way to injure the vision. It is the vendor of improper spectacles who in after years gives a livelihood to the oculist.

These are the principal points to which I wish to call attention, and having done so, there ends my present study of this small portion of the vast subject—school hygiene. The task of accumulating and arranging those data has not been an easy one, and has occupied a good part of my leisure moments during the

past year. But the subject could not be otherwise than interesting, as it relates to the health and comfort of many more than the one thousand pupils whom I examined. Besides, it has been made pleasant by the universal courtesy and aid of the teachers whom I met, and who were in sympathy with every detail of the inquiry. If, therefore, these facts, as here presented, serve to awaken even a fraction of the interest which I believe is their due, I shall be amply repaid for this feeble effort in behalf of children's eyes.

